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Effectiveness of Cold Saline Irrigation on Postoperative Pain after Root Canal Treatment: A Clinical Study

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Abstract

Aim*: To evaluate the effectiveness of cold saline irrigation as a final irrigant on postoperative pain after root canal treatment.*

Material and Methods*: A total of 50 patients with single-rooted teeth were included in the present study. The teeth were randomly divided into two groups. In the cold saline group, final irrigation was performed with 2.5°C saline solution for 5 min after completion of biomechanical preparation; whereas in the control group the same solution stored at room temperature was used. Participants were asked to rate the intensity of their postoperative pain using a visual analog scale after 24 hrs.*

Result*: The result showed that the cold saline irrigation resulted in significantly less pain ($p < 0.05$) in comparison to the control group*

Conclusion*: Cryotherapy was proved to be an effective, practical, and inexpensive method to control postoperative pain.*

Keywords*: Root canal treatment, Cryotherapy, Postoperative Pain.*

Introduction

The field of endodontics is constantly evolving and changing to deliver the best possible treatment for the patient. There is a constant outlook for new and emerging therapies to make patient's experiences and dentist's work as comfortable as possible.**[**1**]** Post endodontic pain (PEP) management and prevention is an integral part of endodontic treatment. Attempts to acquaint the patient with post-operative pain (PEP) and prescribing medications to control it can increase patient confidence in their dentists, increase patients' pain threshold, and ameliorate their attitude towards further dental treatment. According to previously published data root canal treatment (RCT) and, pulp therapy causes more severe and frequent postoperative pain when compared to other dental operative procedures. **[**2,3**]**

Pain during and after endodontic treatment leads to distress to both the patient and the clinician and is often considered a standard of the clinician's skills. **[**4**]** The common factors affecting post-RCT pain include inadequate instrumentation of the canal system, extrusion of the irrigating solution, or the intracanal medicament. This post-treatment pain can be avoided by carefully carrying out each step of the RCT, such as working length determination, proper cleaning and shaping of the canal, optimum use of irrigants, and disocclusion of the tooth. Various other strategized protocols have been employed to decrease the pain incidence, including occlusal reductions, different mechanical techniques during glide path applications and pharmacological means, such as long-acting anesthetic injections, antihistamines, non-steroidal anti-inflammatory drugs (NSAIDs), salicylic acid, acetaminophen, combinations of ibuprofen and acetaminophen, narcotic analgesics, combinations of narcotic analgesics and salicylic acid, and steroidal anti-inflammatory drugs. **[**5,6**]**

Cryotherapy is a new therapeutic option applied in sports medicine and general surgery for the management of pain and for postoperative care. According to Van't Hoff's law, the application of cold to the tissues causes vasoconstriction, decreases cellular metabolism, and inhibits the neural receptors in the skin and subcutaneous tissues. **[**7**]** Cryotherapy produces a local anesthetic-like effect by lowering the conduction velocity of pain signals. The role of cryotherapy in endodontics in the form of irrigating solutions has not been extensively documented. It can be used for inflamed periradicular tissues by intracanal irrigation with a cold solution after instrumentation of the root canal system.8 Hence, the present study is conducted to evaluate the effect of cold saline irrigation on post-operative after root canal treatment.

Material and Methods

The study protocol was approved by the clinical research ethics committee. A total of 50 patients aged between 20-30 years were included in the study. Maxillary or mandibular single-rooted teeth diagnosed with asymptomatic irreversible pulpitis or symptomatic irreversible pulpitis with either normal apical tissues or symptomatic apical periodontitis were included in the study. A tooth with immature apices or

root resorption or with more than single root canals was excluded from the study. Medically compromised patients, individuals who were pregnant, patients using medications such as analgesic or anti-inflammatory drugs, patients who refused to participate in the study, patients who were allergic to local anesthesia were also excluded from the study. Written consent was obtained for the acceptance of the treatment from the patient.

Patients were randomly divided into the control group: Normal saline (Group A = 25) and Cold saline group (Group B = 25). All procedure was explained to the patients and informed consent was obtained before initiating the treatment. All patients were administered local anesthesia of 1:80,000 lignocaine with adrenaline. Access was gained in the symptomatic tooth with a size 4 round bur using an air turbine handpiece under copious water cooling. A size 10 K file was inserted into the root canal to determine the working length with the help of a radiograph. The root canals were instrumented with Protaper Next (Dentsply) using an endodontic motor under copious irrigation with 3% sodium hypochlorite. The root canals were flushed with 5 ml of 17% EDTA solution. In the control group, following completion of biomechanical preparation, final irrigation was performed using 5 ml of 0.9% physiological saline solution at room temperature. In the cold saline group, the root canals were irrigated with 5 ml of cold saline at a temperature of 2.5°C; the solution was stored in the refrigerator until use. The final irrigation was performed for 5 min in both the groups using 27 G beveled needle tip inserted 2 mm short of the WL. In both groups, the root canals were dried with paper points and obturated using 6% 30 gutta-percha cones with zinc oxide eugenol as a sealer. The access cavities were restored with direct composite restorations with a base of high viscosity glass ionomer cement. Each patient was given instruction to assess the post-operative pain/ discomfort. This was carried out using a questionnaire that assessed the numeric evaluation of pain/discomfort. Postoperative pain was determined by using Visual Analogue Scale scores after 24 hrs. The VAS included a 10 cm straight horizontal line numbered at each centimeter with the following criteria; 0-1- no pain; 2-3- mild pain; 4-6- moderate pain; 7-10- severe pain. **(Figure 1)** The data were entered over a spreadsheet, and statistical analysis was performed using SPSS software version 16 (IBM, Chicago, United States).

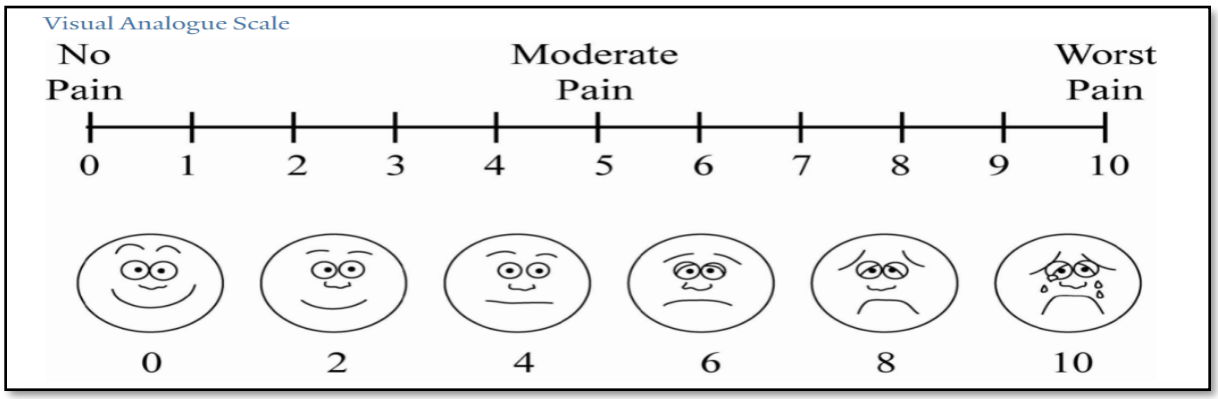

Figure 1: Visual Analogue Scale

Result

Total of 50 subjects were included in the present in-vivo study, out of which 27 patients (54%) were male and 23 (46%) were female with a mean age of 25.54 years, with the age range of 20-30 years. **(Table no.1)**

VAS scale was used to measure post-operative pain. t-test was used to determine the statistical significance. It was found that the mean pain score in the Cold saline group (2.30 ± 0.35) was lower than that of the control group (5.44 ± 0.46). **(Table 2)**

A t-test was used to determine the differences in mean pain scores between the groups. The result obtained was statistically significant with $P < 0.05$, suggesting cold saline irrigation was to be more effective in reducing postoperative pain sensation.

Table no.1 Distribution of Sample	
Gender	%
Male	27 (54%)
Female	23 (46%)
Total	50
Mean Age	25.54

Table no 2: Mean VAS Pain Score		
Group	**Mean VAS Pain Score**	**P value**
Group I Control group	5.44 ± 0.46	P < 0.05
Group II Cold Saline Group	2.30 ± 0.35	

Discussion

The success of endodontic treatment relies on the elimination of microorganisms from the infected root canal system by adequate chemomechanical debridement. This is followed by achieving a hermetic seal through three-dimensional obturation. Even with the utmost care, some patients experience pain or flare-ups during and following the treatment. Pain management during and after root canal treatment is one of the most important aspects of endodontic practice. **[**9**]** Postoperative pain is unpleasant and is reported with a high incidence rate ranging between 3 and 58%. **[**10**]**

The incidence of postoperative pain can be due to various factors which include the condition of the pulp and periradicular tissues, microbial factors, inflammatory chemical mediators, cyclic nucleotide

changes, preoperative pain, type of tooth involved, changes in the local adaptation and the periapical tissue pressure, patient's psychological factors and gender. [11]

This post endodontic pain can be prevented in clinical situations by adopting meticulous measures during the endodontic procedure. Each step of root canal therapy must be done with utmost perfection including accurate determination of working length, proper cleaning and shaping, judicious use of intracanal irrigants, and also the use of magnifying devices, such as dental loupes and endodontic microscopes. [12]

In dentistry, the cold application has been frequently employed for postoperative pain control following intraoral surgical procedures. The word cryotherapy is originated from the Greek word cryo, meaning "cold.' In physiotherapy, it means lowering or decreasing the temperature of tissues for therapeutic purposes. In reality, cryotherapy does not implicit of implementing cold but rather extracting heat. Cryotherapy has been reported to be effective at reducing edema, pain, inflammation, and recovery time with short-term applications in orthopedic, abdominal, gynecological and hernia operations. [13]

The mechanism of action of cold application (cryotherapy) can be divided into three basic actions: decrease in metabolic activity, blood flow, and inhibition in the skin and subcutaneous tissues neural receptors. This renders it efficient in reducing inflammation, pain, edema, and recovery time in the short-term application. The optimum application time of cryotherapy has not been determined. However, different application time according to the depth of tissues was recommended; 3–5 min of cryotherapy was advised when there is minimum fat and muscle, whereas approximately 20 min was recommended for deeper tissues such as the hip. [14,15]

The present study showed that root surface temperature plays a vital root in the manifestation of post-operative pain. Cryotherapy reduced postoperative pain following root canal treatment in teeth with vital pulps probably by reducing external root surface temperature. Saeki et al (2002) [17] stated that pain relief with the cold application could be due to many mechanisms including altered nerve conduction velocity (NCV), vasoconstriction, inhibition of nociceptors, a reduction in muscle spasms and/or a reduction in metabolic enzyme activity levels. The result of our study is in accordance with the study conducted by Gundogdu et al. (2018); they investigated the effect of intracanal, intraoral, and extraoral cryotherapy on postoperative pain in molar teeth in 100 patients with symptomatic AP. All cryotherapy groups showed less pain with percussions and lower postoperative pain in comparison with the control group after 1, 3, 5, and 7 days.

Conclusion

Cryotherapy was proved to be an effective, practical, and inexpensive method to control postoperative pain. Further studies in this field are necessary to approve the use of cryotherapy in clinical practice.

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